



Water Requirements for Fossil-Based Electricity Plants with and without Carbon Capture

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Office of Systems, Analyses, and Planning

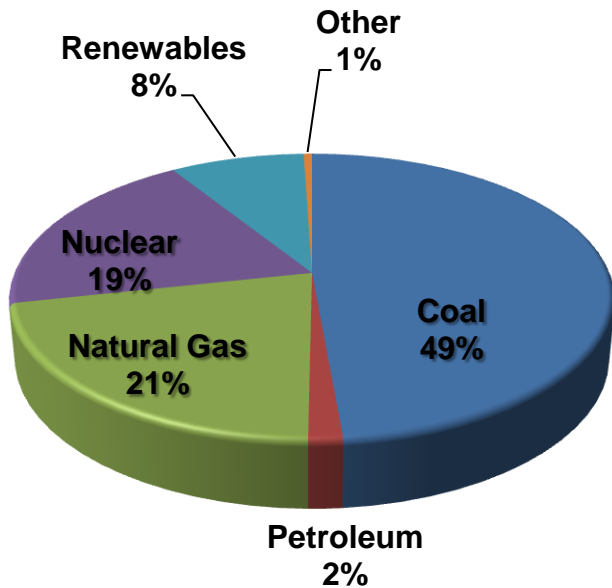
2009 GWPC Annual Forum

Salt Lake City, UT

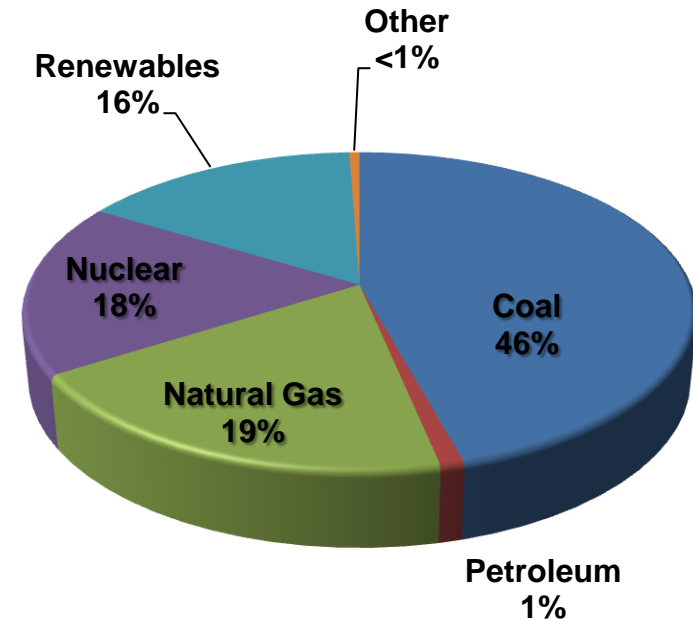
9/15/2009

Generation

Generation 2007
4,159 Billion kWhr



Generation 2030
5,055 Billion kWhr



+22%
Total

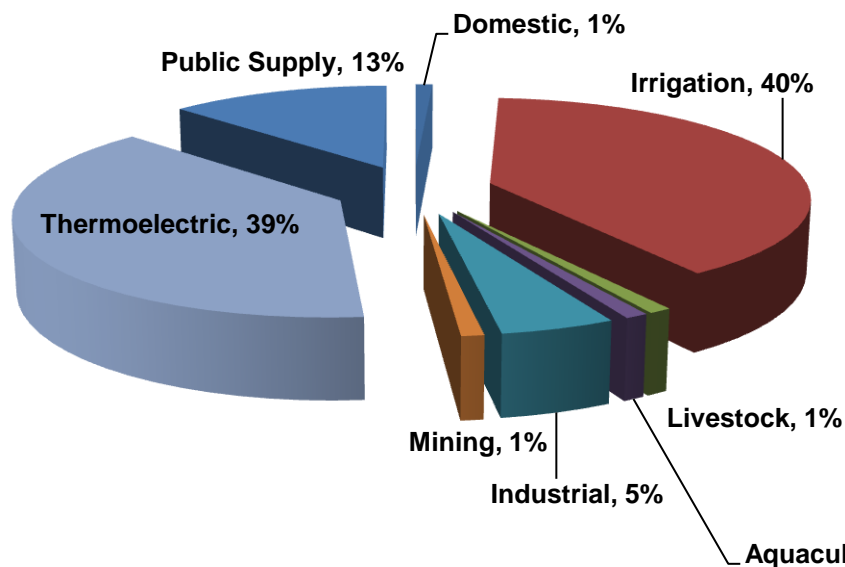
Coal 2007
2,021 Billion kWhr

+14%
Coal

Coal 2030
2,311 Billion kWhr

Competing Water Demands

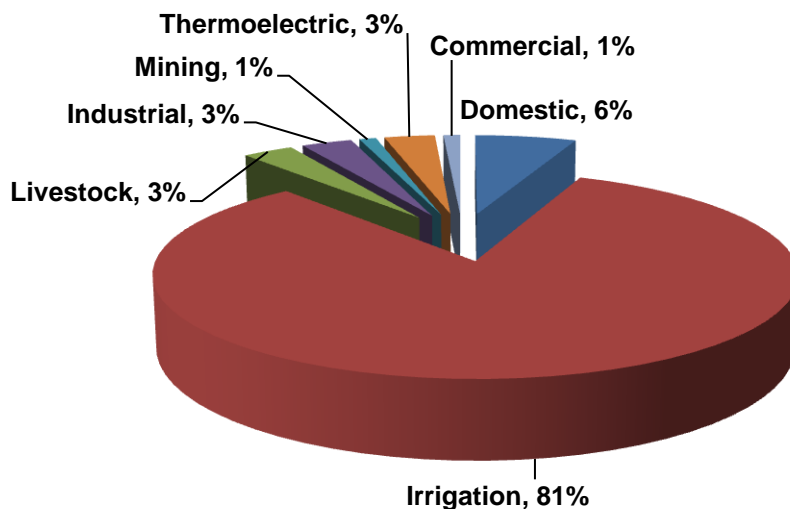
U.S. Freshwater Withdrawal¹



•2000 Thermoelectric water requirements:

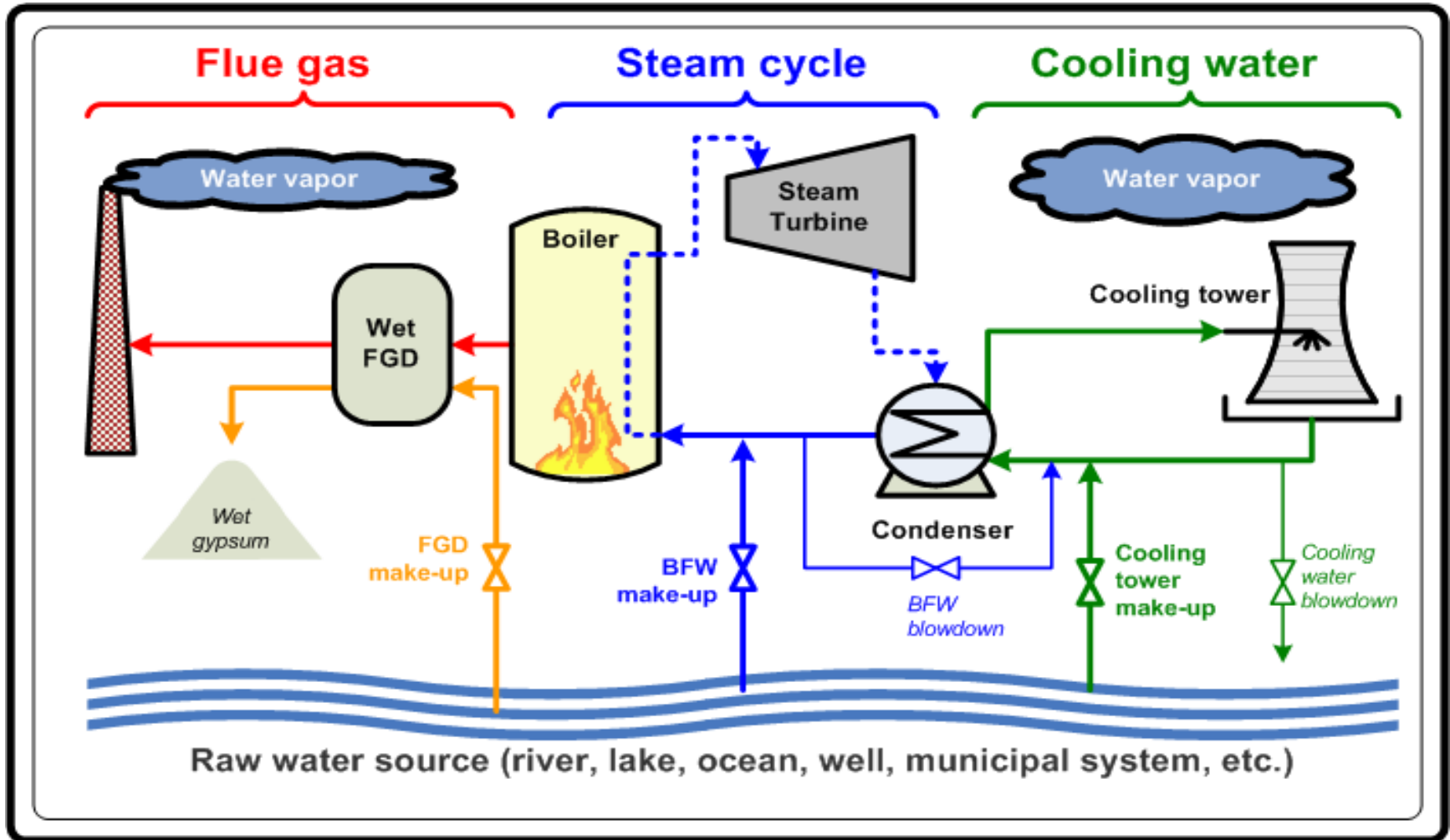
- Withdrawal: ~ 136 BGD
- Consumption: ~ 4 BGD

U.S. Freshwater Consumption²

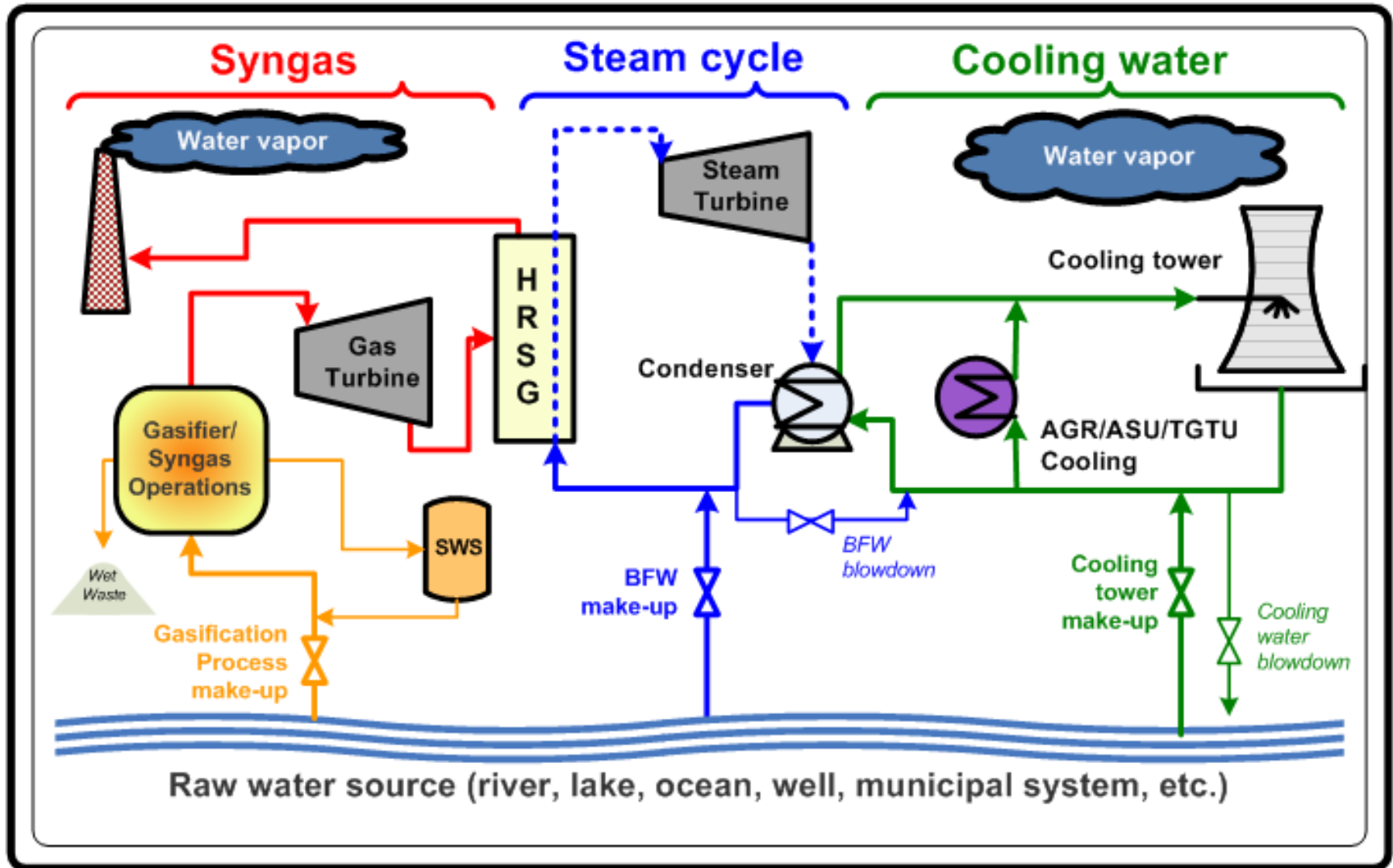


- Thermoelectric power plants compete with other sectors.

Water Flow Schematic Coal Power Plant

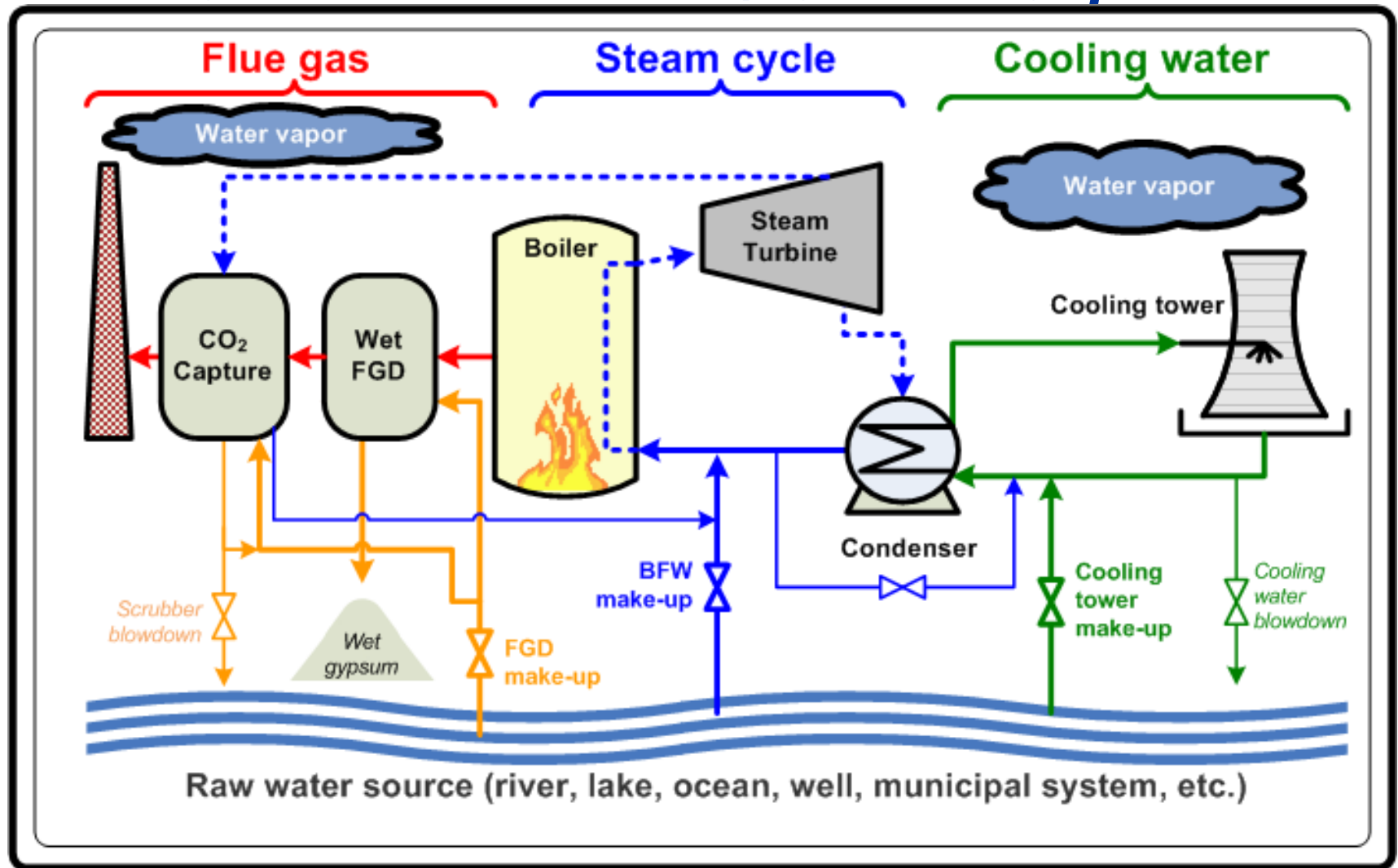


Water Flow Schematic IGCC Power Plant



Water Flow Schematic

Coal Power Plant w/ Carbon Capture



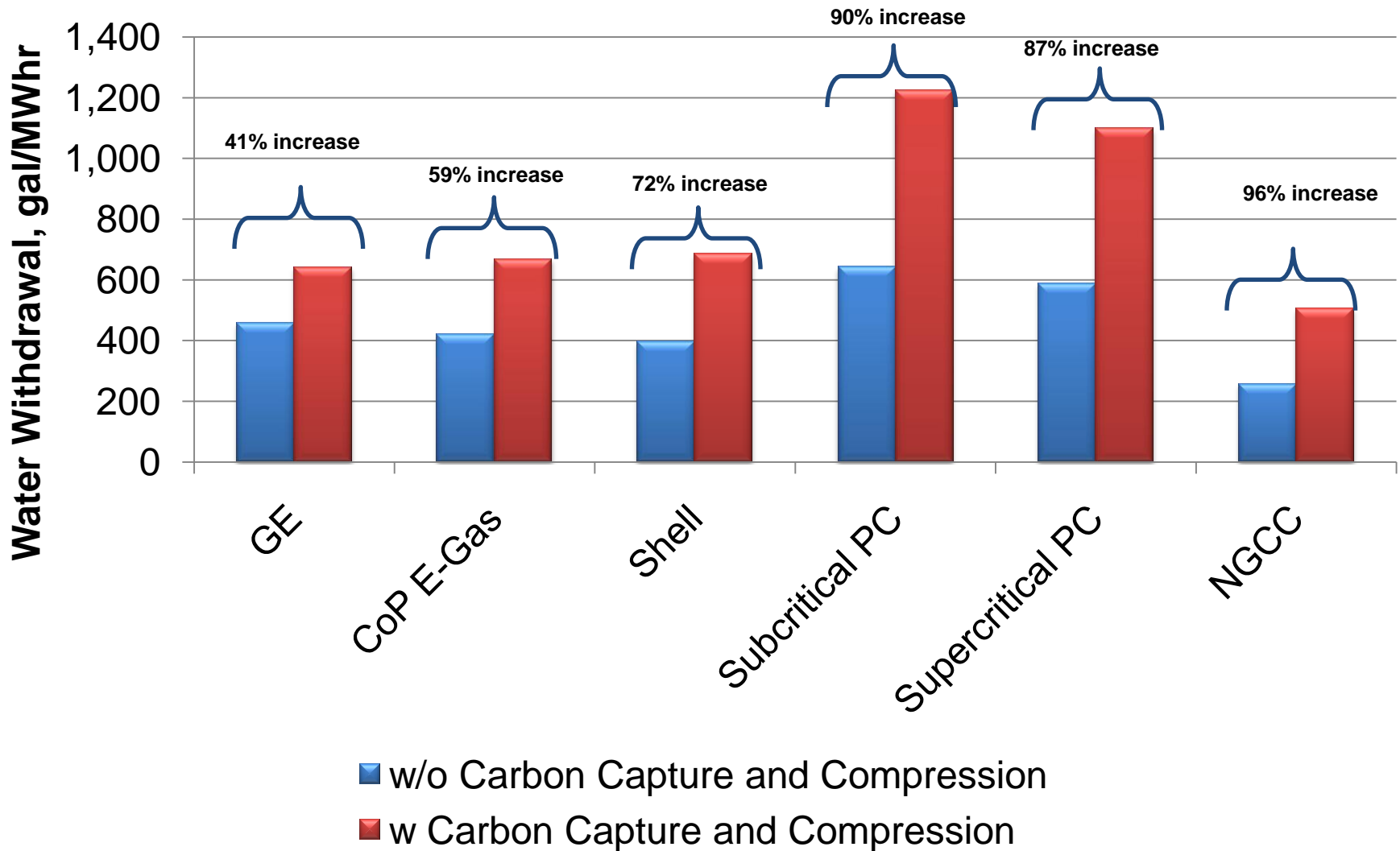
Water Balances

- **Ambient conditions typical of a Generic Midwestern site**
- **Greenfield Plants w/ and w/out CO₂ Capture**
 - PC w/ wet FGD
 - IGCC
 - Slurry Feed
 - Dry Feed
- **Wet Cooling Systems**

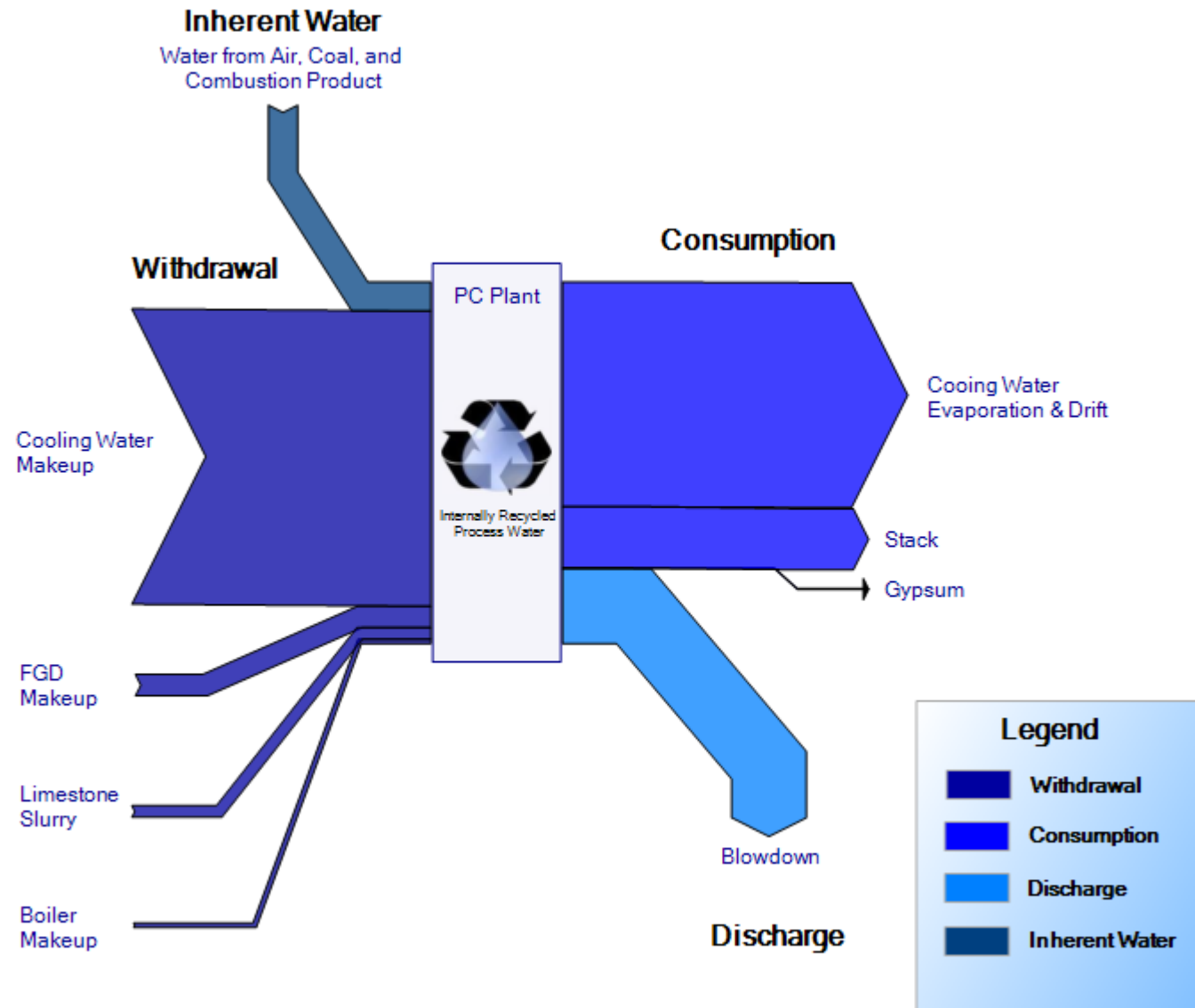
**Cost and Performance Baseline for Fossil Energy Power Plants study,
Volume 1: Bituminous Coal and Natural Gas to Electricity** Rev 1 8/2007

Water Withdrawal

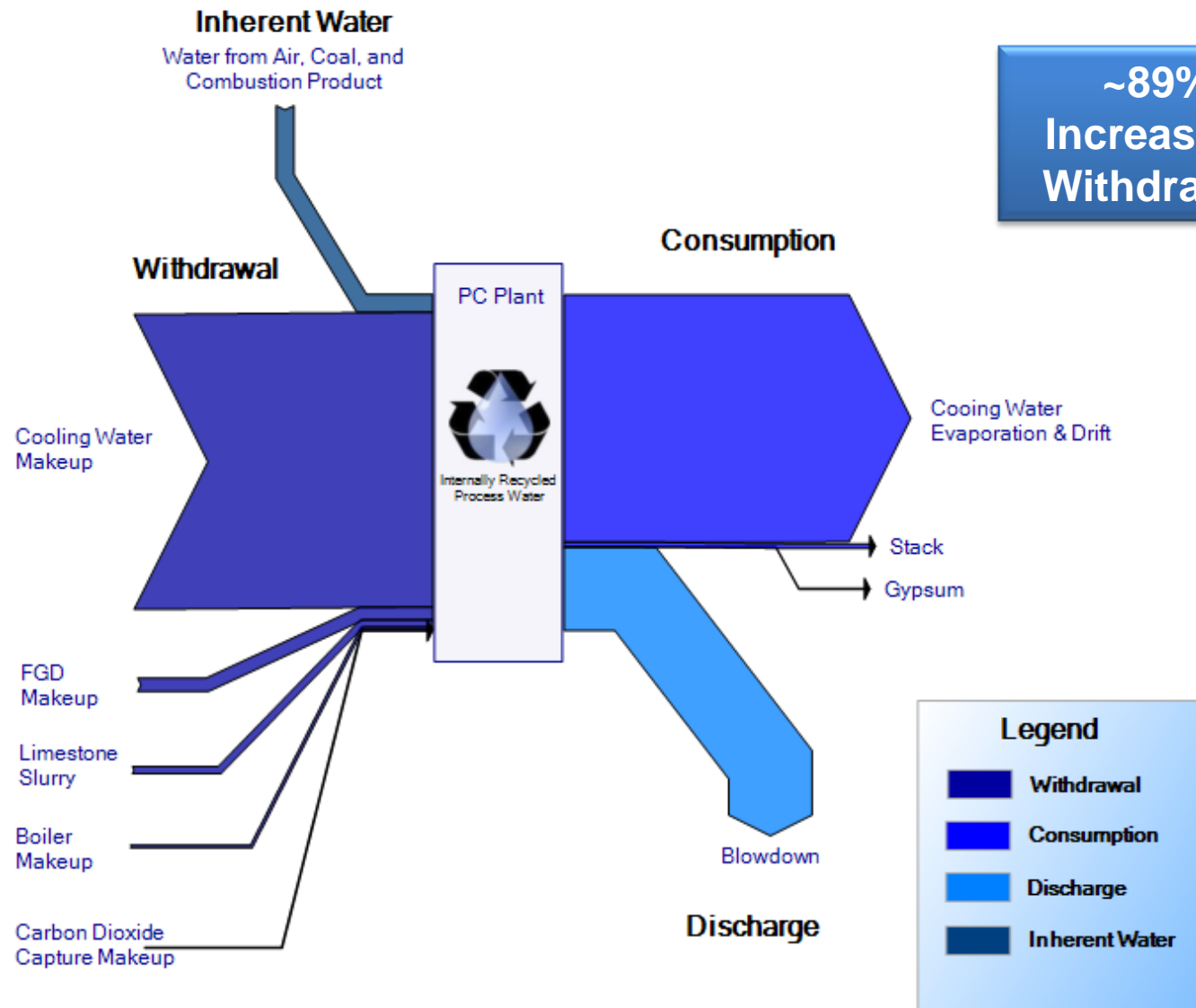
Fossil-Based Plants



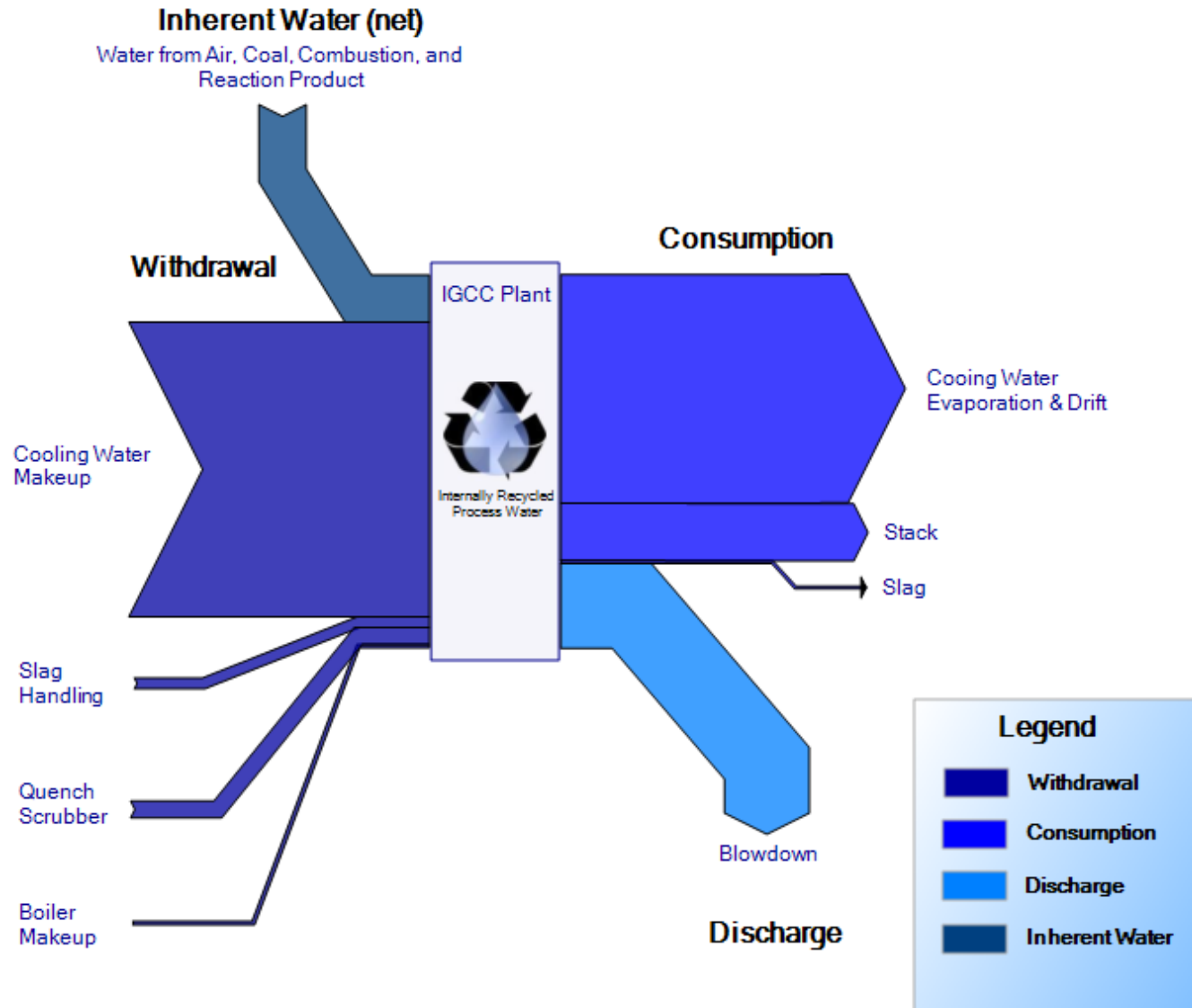
Pulverized Coal Plant



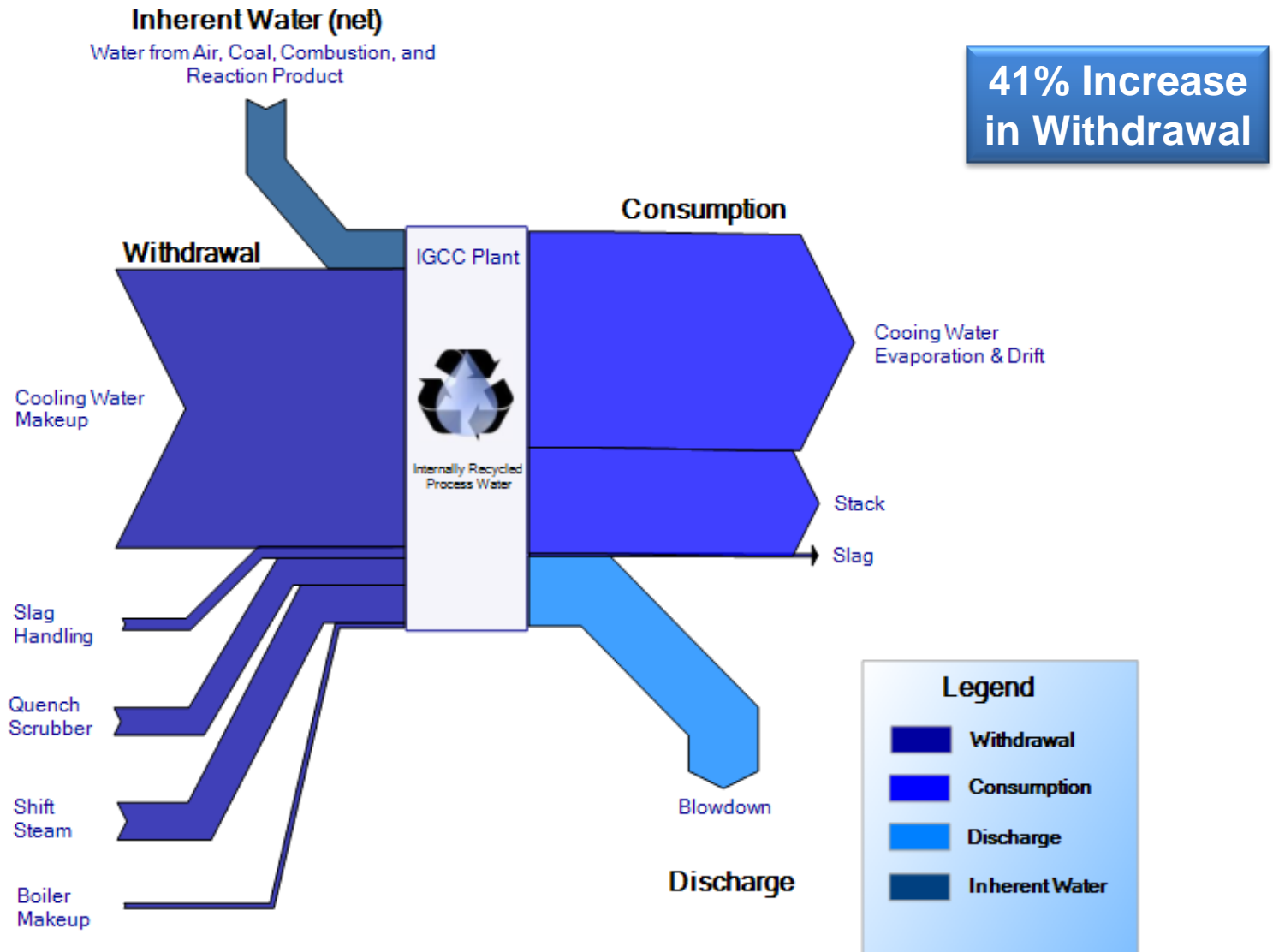
Pulverized Coal Plant *with CO₂ Capture*



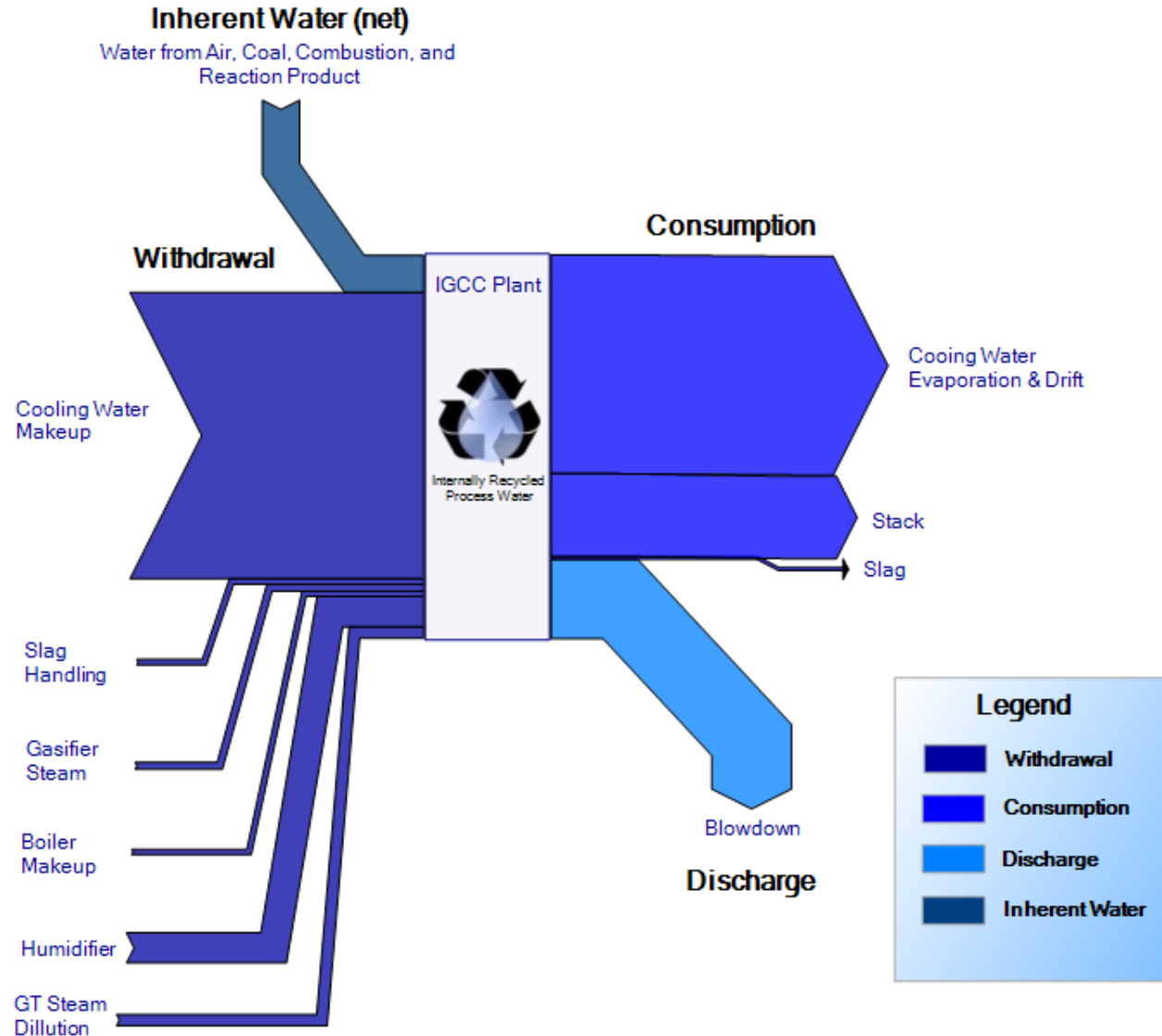
Slurry-Feed IGCC



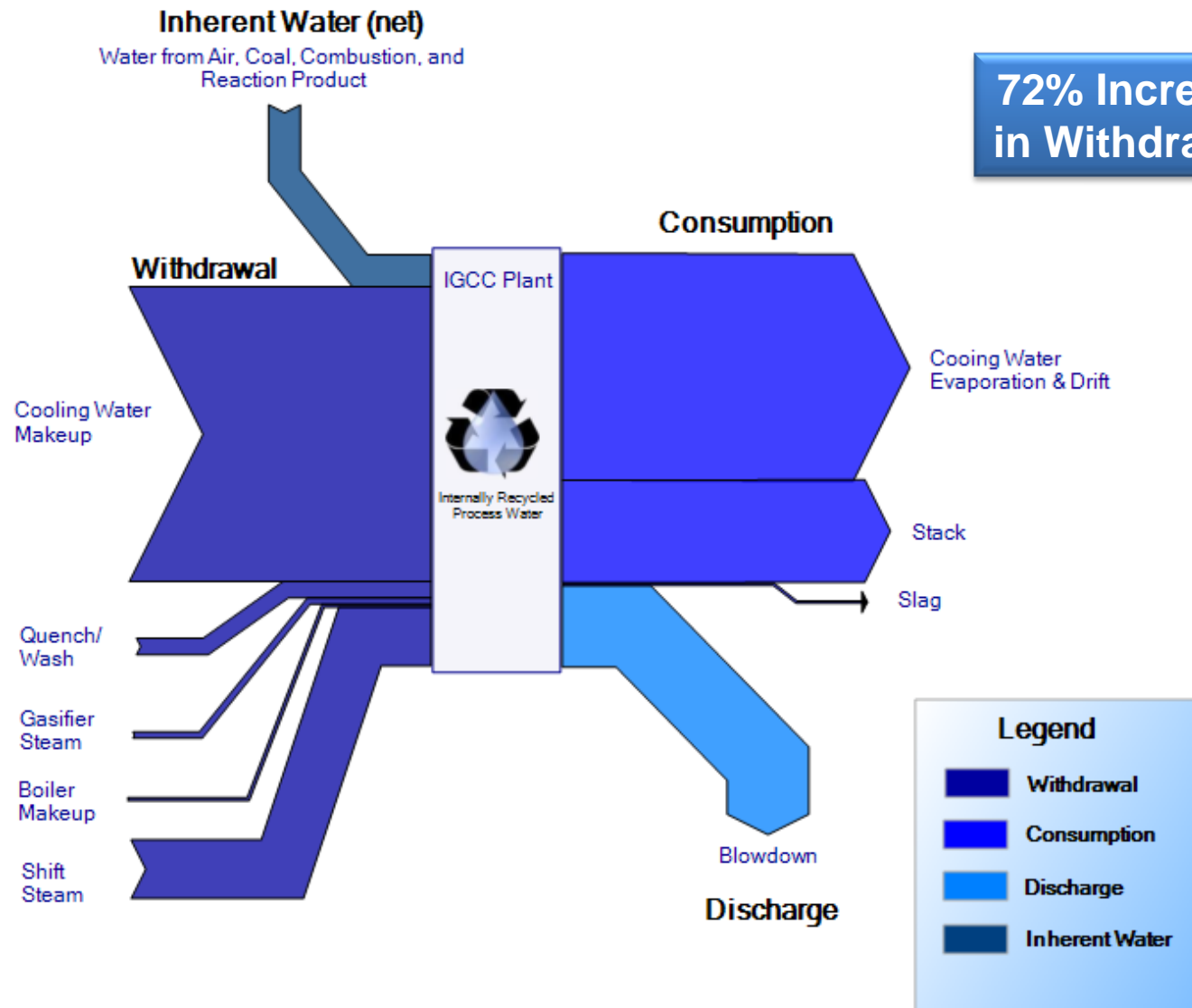
Slurry-Feed IGCC w/ CO₂ Capture



Dry-Feed IGCC

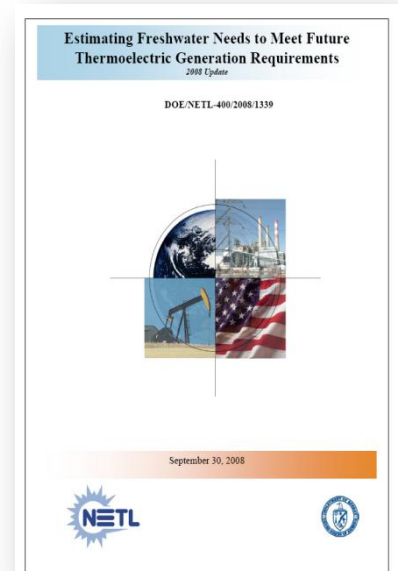


Dry Feed IGCC w/CO₂ Capture

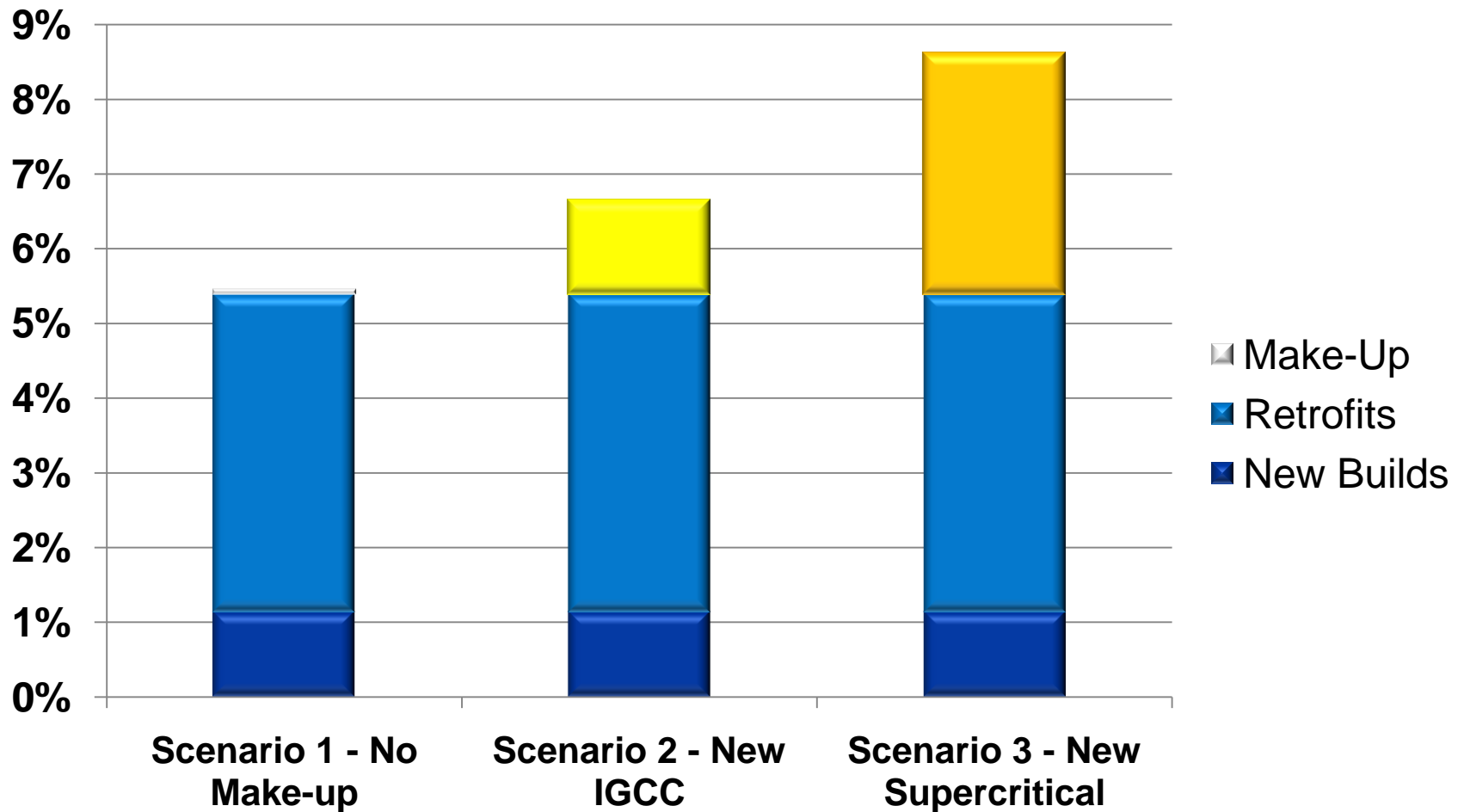


NETL's Water Needs Report

- **Thermoelectric Power Generation**
 - coal steam, combined cycle, other fossil steam, and nuclear
- **Projected national and regional freshwater withdrawal and consumption through 2030**
- **Examined water use of deployed coal-fired power plants with carbon capture technologies**

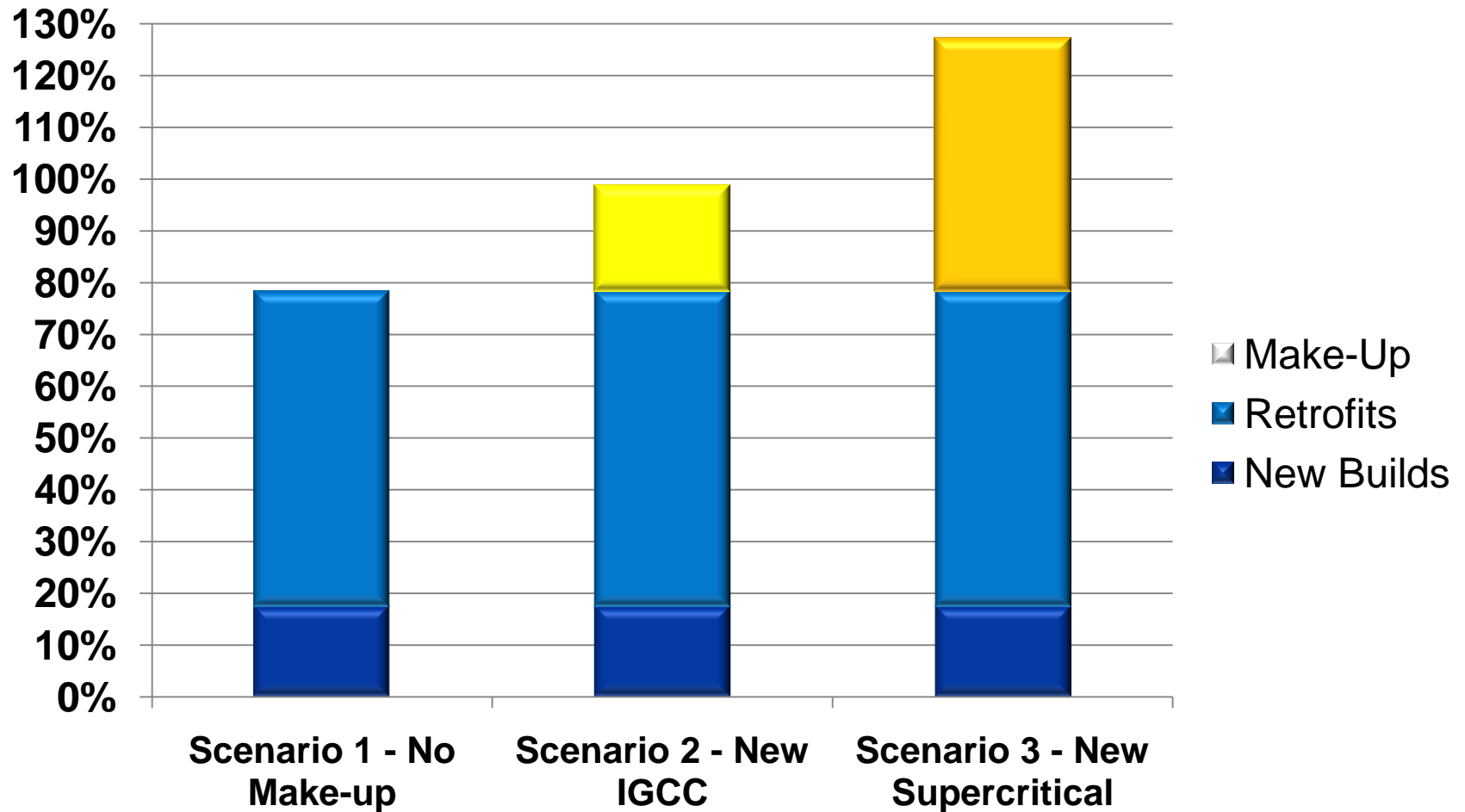


% Increase Freshwater Withdrawal for Coal-Fired Power Generation (2030)



Base: 66 BGD Coal-fired generation fleet with no capture

% Increase Freshwater Consumption for Coal-Fired Power Generation (2030)



Base: 3.2 BGD Coal-fired generation fleet with no capture



The screenshot shows the NETL Energy Analysis website. The header features the NETL logo (a sunburst with 'NETL' inside) and the text 'the ENERGY lab' and 'Where energy challenges converge and energy solutions emerge'. A 'Site Map' link and a 'GO' button are also present. The left sidebar contains a navigation menu with links: ABOUT NETL, KEY ISSUES & MANDATES, RESEARCH, TECHNOLOGIES, ENERGY ANALYSIS (highlighted in orange), About Us, Search, Products, Contacts, SOLICITATIONS & BUSINESS, EDUCATION, NEWSROOM, and CONTACT NETL. The main content area is titled 'Energy Analysis' and includes a 'HIGHLIGHT' section for 'World CO₂ Emissions - Projected Trends Tool' (SWF-608KB) from July 2009, with contact information for Erik Shuster. Below this is a 'NEW RELEASES' section with two items: 'Opportunities to Improve the Efficiency of Existing Coal-fired Power Plants' (PDF-317KB) from July 2009, and 'Systems Analysis of an Integrated Gasification Fuel Cell Combined Cycle' (PDF-2.8MB) from August 2009. The right sidebar contains a 'SEARCH' section with links to 'Search' and 'Tips', a 'TOPICS' section, a 'DATE RANGE' section, a 'PUBLICATION TYPE' section, an 'Energy Calculator' section with a 'GO' button, and an 'RSS EA Registration Page' link. The Department of Energy seal is visible in the bottom left corner of the website layout.